FW FOR

MODEL 1700B
INTERMODULATION DISTORTION ANALYZER
OPTION 004

SOUND TECHNOLOGY

(P) 1652

MODEL 1700B
INTERMODULATION DISTORTION ANALYZER
OPTION 004

SOUND TECHNOLOGY

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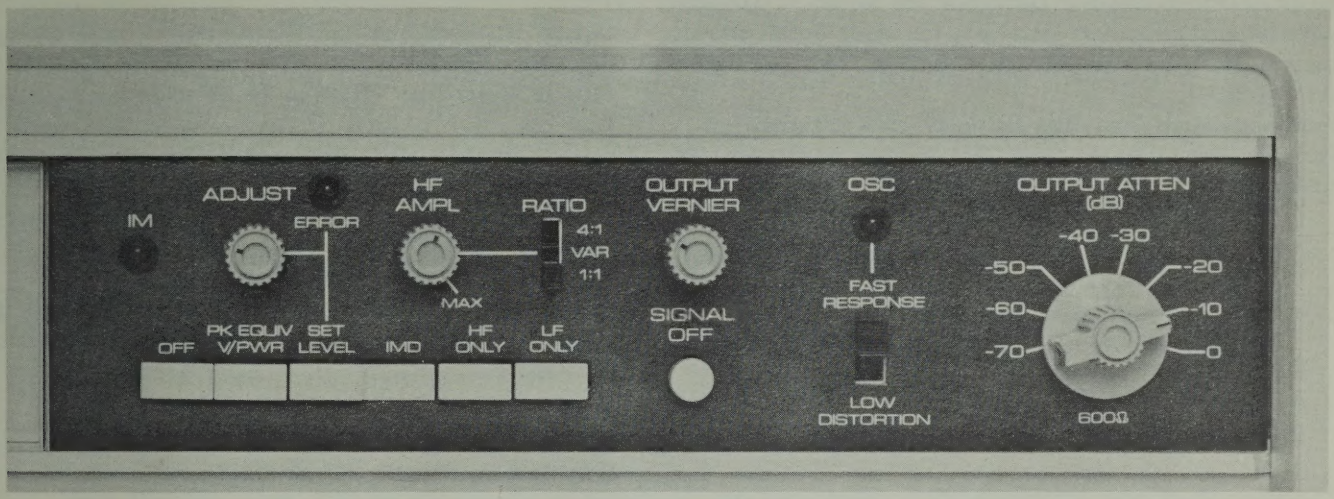
All new Sound Technology products are warranted against defects in materials and workmanship for one year from the date of delivery. Any instrument or component that is found to be defective within the warranty period after examination by Sound Technology or an authorized representative thereof will be repaired or replaced without charge for labor or material. No other warranty is expressed or implied. We are not liable for consequential damages.

Before returning a product to Sound Technology for service, authorization must be obtained from the factory. For products not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay. Please include instrument model number and serial number with all requests for parts or service to facilitate the fastest possible response.

All products returned to the factory must be shipped prepaid. For products under warranty, Sound Technology will pay for shipment back to the customer.

INTERMODULATION DISTORTION ANALYZER



Measure total harmonic distortion and intermodulation distortion with one instrument —

THIS OPTION FITS RIGHT IN THE 1700B DISTORTION MEASUREMENT SYSTEM

- Measures Intermodulation Distortion down to .0025%.
- 70 dB Output Attenuator tracks 1700B Input Switch for rapid measurements, works when measuring THD, too.
- Available with automatic set level to cover between 10 dB steps for even faster operation.
- 4:1 and 1:1 ratios are switch selectable. No HF or LF adjustment required.
- Continuously adjustable LF:HF ratio lets you choose the ratio you want using the 1700B meter.
- Measures peak equivalent single-tone voltage or power.

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Specifications

MEASUREMENT SECTION

All 1700B specifications and performance features are retained with the following additions.

Intermodulation Distortion Ranges: 0.01% to 100% full scale in 9 ranges.
Residual Intermodulation Distortion and Noise: $<$ 0.0025% with internal generators set at 4:1 for input signals greater than 0.3V (10 mw across 8Ω). $<$ 0.004% for input signals 0.1V to 0.3V.
Intermodulation Distortion Accuracy: ±2% full scale.
Peak Equivalent Single Tone RMS Voltage Accuracy: ±2% full scale.

GENERATOR SECTION

Output attenuator and vernier control the single tone sine-wave oscillator output as well as the intermodulation distortion generator output. All 1700B oscillator specifications apply except output level control is via the attenuator and output impedance is 600Ω.

Output Voltage: 1mV to 3V open circuit, peak equivalent single tone RMS.
Output Attenuator: 70 dB in 10 dB steps, accurate within ±0.1 dB.
Output Vernier: $>$ 10 dB range, continuously adjustable.
Output Impedance: 600Ω ±1%.
Low Frequency Generator: 50 or 60 Hz synchronized with power line. Total Harmonic Distortion $<$ 0.1%.
High Frequency Generator: 7 kHz ±1%.
LF/HF Ratio: Switch selectable 4:1 ±1% or 1:1 ±2%. Continuously variable from 1:1 to $>$ 100:1 with HF amplitude control.

GENERAL

Weight: Adds 5 lbs. to 1700B weight.

Data subject to change without notice.

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1-1. INTRODUCTION

This supplement provides operating and service information for the Model 1700B Intermodulation Distortion (IMD) Analyzer Option 004. The information contained in the supplement pertains to the IMD option only. Consult the Model 1700B manual for additional information regarding primary power requirements, grounding details, and cabling instructions.

1-2. MEASUREMENT TECHNIQUE

The IMD option is based on the SMPTE (Society of Motion Picture and Television Engineers) method to measure IMD whereby a large 60-Hz signal is combined with a small 7 kHz signal in a four-to-one amplitude ratio. Passing this combined (composite) signal through a non-linear device results in the appearance of new frequencies above and below 7 kHz in multiples of 60 Hz. The effect of these new frequencies is amplitude modulation of the 7 kHz signal, which can be detected.

The component parts of the IMD option include a signal source and an IM analyzer. The signal source generates a low-frequency sinusoid and a high-frequency sinusoid that are mixed and fed to the input of the device under test. Level controls are provided so that the amplitude of the composite signal can be set to the desired level. The signal from the output of the device under test is then fed back to the analyzer circuits of the IMD meter. A high-pass filter removes the low frequency, leaving only the high frequency together with any possible low-frequency modulation. This signal is input to an envelope detector (or absolute value detector) resulting in only the rectified carrier with its amplitude varying at a low-frequency rate. A low-pass filter removes the carrier, leaving only the modulation products. The amount of these products is indicated on the meter in terms of percentage of the high-frequency signal passed through the high-pass filter.

1-3. IMD OPTION

This option adds IMD measurement capability to the Model 1700B Distortion Measurement System. It employs the IMD measurement technique described above and in addition provides the user with a number of unique operating features. These are detailed in the following paragraphs.

The IM signal source contains a 60 Hz low-frequency oscillator and a 7 kHz high-frequency oscillator. Controls on the front panel permit a rapid selection of a composite test signal having fixed low-frequency to high-frequency ratios of 4:1 or 1:1 plus a variable ratio of greater than 16:1 to 1:1. The amplitude of the test signal is controlled by an accurate 10 dB-per-step attenuator with a range of 70 dB and by a 10 dB vernier control. The amplitude of the composite test signal can be measured directly in peak equivalent rms single tone voltage or power. This parameter, specified by the Institute of High Fidelity for IMD measurements, is defined as the voltage or power level of a sine-wave signal having a peak value equal to the peak value of the composite IM test signal. The ability to make this measurement eliminates the need for meter reading conversion or matching oscilloscope waveforms.

The IMD option combines with the Model 1700B input circuits to provide the option with a differential input configuration. In operation, the IM analyzer is capable of measuring IMD at all power levels between one milliwatt and ten kilowatts across eight ohms, with a residual intermodulation distortion of less than .0025 percent (.004 percent) at one milliwatt). Meter sensitivity ranges from 100 percent to .01 percent full scale. The analyzer can also measure the LF-to-HF voltage ratio of the IM test signal from (a) input to the device under test or (b) output from the device to the analyzer. When the analyzer is used with a Model 1700B fitted with Auto Set Level (Option 003) it is possible to perform IMD testing within the range of one milliwatt to ten kilowatts without adjusting the SET LEVEL control. This feature facilitates testing volume compressors/expanders and similar non-linear devices. Operation with the Auto Set Level option also permits the user to switch from Total Harmonic Distortion (THD) testing to IMD testing without having to make adjustments to compensate for the frequency response of the device under test.

2-1. CONTROLS and INDICATORS

The data sheet at the front of this supplement describes the controls and indicators on the front panel of the Model 1700B IMD option. The following provides additional explanatory information.

a. OFF pushbutton -- Switches system measurement mode from intermodulation distortion (IMD) to total harmonic distortion (THD). System is in THD mode when pushbutton is in.

b. PK EQUIV V/PWR pushbutton -- Selects measurement mode whereby meter displays amplitude of IM test signal in peak equivalent rms single tone voltage or power.

c. OUTPUT ATTEN control -- Varies level of IM test signal in 10 dB steps.

d. OUTPUT VERNIER control -- Varies level of IM test signal over a 10 dB range.

NOTE

When the IMD option is installed in the 1700B, the output signal is routed through the output attenuator and output vernier at all times, regardless of whether the instrument is in the IMD or THD mode of operation.

e. RATIO slide switch -- Selects desired low-frequency to high-frequency amplitude ratio of composite IM test signal. Two fixed ratios (4:1 and 1:1) are available. The VAR (variable) position allows selection of a ratio variable from greater than 16:1 to 1:1 with adjacent HF AMPL control.

f. HF AMPL control -- Adjusts LF:HF ratio of composite IM test signal when RATIO slide switch is set to VAR position. MAX setting (fully clockwise) selects a 1:1 ratio.

g. HF ONLY pushbutton -- Turns off low-frequency oscillator. When pushbutton is in, only the high-frequency signal is present at SIGNAL OUTPUT connector.

h. LF ONLY pushbutton -- Turn off high-frequency oscillator. When pushbutton is in, only the low-frequency signal is present at the output.

i. SET LEVEL pushbutton -- Selects set level function whereby meter displays amplitude of reference high-frequency signal required for IMD measurement.

j. ADJUST control -- Adjusts amplitude of reference signal for IMD measurement.

k. ERROR indicator -- Lights during Auto Set Level (Option 003) operation when adjacent ADJUST control is incorrectly set. Correct setting is achieved by turning ADJUST control until indicator is extinguished. Light will also go out if composite input signal is either below 20% or greater than 150% of full scale.

l. IMD pushbutton -- Selects intermodulation distortion measurement function.

m. IM indicator -- Lights when system is in IMD measurement mode i.e., whenever PK EQUIV V/PWR, SET LEVEL, or IMD pushbutton is in and HF ONLY and LF ONLY pushbuttons are out.

2-2. OPERATING INSTRUCTIONS

2-3. TEST SET-UP

Refer to Section I of the Model 1700B manual and connect the equipment as shown in Figure 1-1. Also, read and follow the instructions given in paragraphs 1-6 through 1-9 of the same manual before making any IMD measurements. Sync the test oscilloscope to the line frequency and set sweep speed to 5 msec/div.

2-4. IM DISTORTION MEASUREMENT WITH 4:1 or 1:1 LF:HF AMPLITUDE RATIO.

To measure intermodulation distortion with a 4:1 LF:HF composite signal, proceed as follows:

a. Set Model 1700B ADJUST control to CAL position or AUTO (for auto set level).
b. Set IM RATIO switch to 4:1.
c. Press PK EQUIV V/PWR pushbutton.

d. Ensure that HF ONLY and LF ONLY pushbuttons are in the out position.
e. Set Model 1700B INPUT switch to desired range setting. Adjust OUTPUT ATTEN switch and OUTPUT VERNIER control for desired rms peak equivalent single tone voltage/power reading. Ensure that meter indication is in upper two-thirds of scale.
f. Push IM SET LEVEL pushbutton and turn adjacent ADJUST control until meter reads full scale. Omit this step if using auto set level. (See Section 2-6)
g. Push IMD pushbutton. Adjust Model 1700 B RATIO switch until meter deflection is in upper two-thirds of scale, if possible.
h. Read distortion in either percent or dB as indicated by meter deflection and RATIO switch range setting. For example, if meter reads .67 and RATIO range is 0.1 PERCENT, distortion reading is .067%.
i. To switch the 1700 to the THD mode, push the OFF pushbutton on the IM panel.

NOTE

It is normal for the 1700 B oscillator to go through a few cycles of stabilization when switching from the IMD mode to the THD mode. This is due to the power supply for the main oscillator being turned off when in the IMD mode.

To make an IM distortion reading with a 1:1 LF:HF signal, set the IM RATIO switch to 1:1 and then carry out steps c through i above. Signal output level will increase about 55% when switching from 4:1 to 1:1 .

2-5. IM DISTORTION MEASUREMENT WITH NON-STANDARD LF:HF RATIO

To perform an IM distortion measurement using a LF:HF amplitude ratio other than 4:1 or 1:1, proceed as follows:

a. Set Model 1700 B ADJUST control to CAL position or AUTO (for auto set level).
b. Set IMD option controls as follows:
PK EQUIV V/PWR pushbutton ----------IN
IM RATIO switch ----------VAR
LF ONLY pushbutton ----------IN
HF ONLY pushbutton ----------OUT
ANALYZER SELECT ----------INPUT or GENERA
OUTPUT AS DESI
c. Adjust Model 1700B INPUT switch, and OUTPUT ATTEN and OUTPUT VERNIER controls for a full-scale reading on an appropriate meter voltage scale.
d. Calculate inverse of desired LF:HF ratio. For example if desired ratios is 16:1, inverse would be 1:0.0625, LF:HF.
e. Set LF ONLY button to out position and press HF ONLY pushbutton. Now adjust HF AM control until meter indicates relative high-frequency level determined in step d. For example, for a 16:1 ratio, the HF AMPL control should be adjusted to obtain a meter reading of .0625 of full scale. The INPUT switch can be stepped down to obtain a more accurate reading of the high-frequency signal. For the 16:1 ratio, the INPUT switch can be stepped down two positions, adjusting the meter reading to .625 on the 0-1.0 meter scale.
f. Now set HF ONLY pushbutton to out position and follow steps c through i of paragraph 2-4.

2-6. IM DISTORTION MEASUREMENTS WITH AUTO SET LEVEL SET

To make an IM distortion measurement using a Model 1700 B fitted with the Auto Set Level option proceed as follows:

a. Turn Model 1700B ADJUST control fully counter-clockwise past CAL position until detent position is reached. This activates the Auto Set Level circuit. The gain of the intermodulation analyzer must be within a certain range for the Auto Set Level to function correctly. The ERROR indicator lights whenever the intermodulation analyzer gain is not within the necessary gain "window". In this event, turn the IM ADJUST control until the ERROR indicator is extinguished. For a further explanation of this see section 3-3.
b. Follow steps described in paragraphs 2-4 and 2-5.
c. Observe ERROR indicator; rotate IM ADJUST control until an off "window" is found; then set the IM ADJUST control to the window's approximate center.
d. To switch the 1700 B to the THD mode, push the OFF pushbutton on the IM panel. (It is normal for the 1700B oscillator to go through a few cycles of stabilization when switching from the IMD mode to the THD mode.)

-1. INTRODUCTION

This section contains a functional description of the IM signal source and the M analyzer - the principle components of the IMD option. For a description of the IMD easurement technique employed by the option and a description of its operating features, efer to Section I of this supplement.

-2. IM SIGNAL SOURCE

Refer to the schematic diagram in Section VI of this manual. The IM signal source nsists of two Wien bridge RC oscillators, a summing amplifier, and an output attenuator. e low-frequency (LF) oscillator operates at 60 Hz and is synced to the line frequency. e oscillator has an output amplitude of 6.3 volts rms (nominal). The high-frequency (HF) cillator operates at 7 kHz and also has an output of 6.3 volts rms (nominal). The HF cillator is optimized for maximum amplitude stability. The signals from both oscillators e coupled to the input of a summing amplifier that supplies the composite IM test signal.

The amplitude ratio of the two frequencies is controlled by varying the amplitude of e HF signal input to the summing amplifier. When the front-panel RATIO slide switch is t to the 1:1 position, the full 6.3 volts rms (nominal) HF signal is delivered to the mming amplifier. When the RATIO slide switch is set to the 4:1 position, a resistive vider attenuates the HF signal by a factor of four, so that the HF level at the summing plifier output is one-quarter that of the LF level. When the RATIO switch is set to VAR sition, a potentiometer controlled by the front-panel HF AMPL knob permits the level the HF input to the summing amplifier to be set to any level between zero and 6.3 volts rms.

The IM signal source is operable only when the IMD switch is set to the IM (out) sition. This disconnects dc operating voltage from THD low-distortion oscillator and lows the 60-Hz and 7 kHz oscillators to turn on. When the IMD OFF switch is pressed, dc wer is connected to the THD low-distortion oscillator and at the same time dc voltages are plied to the two IM oscillator circuits biasing them to an off state.

The output attenuator consists of a ladder-type step attenuator in series with a 10-dB " attenuator. The ladder section has attenuation steps of 0, 20, 40 and 60dB, changing every second setting of the front-panel OUTPUT ATTEN switch. Thus, the attenuation of the dder section is 0 dB for the 0-dB and 10-dB switch settings, 20 dB for the 20-dB and 30-dB ttings etc. The 10-dB "L" section is bypassed on the 0-, 20-, 40-, and 60-dB switch ttings and connected in series with the ladder section on the 10-, 30-, 50-, and 70-dB ttings. This provides the output attenuator with a range of 0 dB to 70 dB in 10-dB steps. e attenuator has a constant output impendance of 600 ohms.

3. IM ANALYZER

The following is a discussion of the IM analyzer board and Model 1700B circuits that mprise the IM analyzer. Refer to the schematic diagrams in the Model 1700B manual and ction VI of this manual for circuit details.

The IM test signal from the device under test is connected via the Model 1700B INPUT rminals to the INPUT attenuator and from there to the differential input buffer and fferential-to-single-ended buffer. The ouput signal from the buffer amplifier (in the nge of 1 to 3.16 peak equivalent volts), is coupled via a passive 2-pole high-pass filter the input buffer. The filter attenuates the 60Hz component of the IM signal by approx- ately 26 dB. The gain of the input buffer is variable from 2 to 100 by the front panel IM JUST control. This allows the amplitude of the signal at the output of the IM buffer P1) to be set to approximately 3.16 volts, the correct set level for the IM distortion asurement.

From the IM input buffer, the signal is connected to an active 7-pole, high-pass filter ving a cut-off frequency of 2kHz. This attenuates the 60 Hz by a further 210 dB, leaving ly a pure 7 kHz sine wave plus any amplitude modulation caused by the non-linearity of e device under test. From here, the signal is connected to an absolute value detector at rectifies the 7 kHz waveform.

When the IM SET LEVEL pushbutton is pressed the output of the absolute value detector which is essentially a dc level representing the amplitude of the 7 kHz component of the test waveform, is connected through switch S3 to the front panel meter. This permits monitoring the amplitude of the HF component of the input signal for Set-Level adjustments.

The output of the absolute value detector is also coupled to a 7-pole, low-pass filter with a cut-off frequency of 500 Hz. This removes the 7 kHz component from the rectified signal, leaving only the intermodulation products. The output from the low-pass filter is connected to the THD RATIO attenuator and distortion amplifier through OFF switch, S1. The amplifier output is 31.6 mV full scale for each attenuator setting.

An IM measurement is made by pressing the IMD pushbutton, connecting the distortion amplifier output via the auto set level option and the IM meter amplifier to the front panel meter. If the auto set level option is not fitted, the signal is jumpered directly from the distortion amplifier to the IM meter amplifier. Also, when the system is in the IM measurement mode, a relay bypasses the 400 Hz and 80 kHz filters located between the distortion amplifier output and the input of the auto set level circuit. This relay is on the THD analyzer board and activated through a contact on relay K1, located on the IM analyzer board.

When the PK EQUIV V/PWR pushbutton switch S2 is pressed, the output of the THD meter preamplifier is connected via the IM peak detector to the front-panel meter. The THD meter preamplifier has a 31.6 mV full scale output on each range of the INPUT attenuator and the peak detector buffer has a gain of approximately 22. This changes the 31.6 mV full scale signal to approximately one volt peak at the peak detector input and causes one milliampere of current to be supplied to the meter for a full scale reading.

The peak detector, consisting of U9 and associated components, operates as a summing amplifier. The input to the circuit may be considered to be at the junction of capacitor C46 and resistor R36. The detector responds to negative input peaks. Meter current (average one milliampere full-scale) flows back to the summing point through resistor R38. If the peak negative input current through R36 exceeds the feedback current, the output of U9 will go positive and add charge to C55 through emitter-follower Q1. This added charge will then increase the average meter current: As long as the output of U9 swings positive each cycle, Q2 will conduct each cycle, thus holding down the voltage on C54 and preventing Q3 from conducting. If the peak input current does not exceed the feedback current, the output of U9 remains clamped negative by diode CR5 at approximately 0.7 volts. In this event, the voltage on C54 will rise, and Q3 will conduct to quickly reduce the charge on C55. This allows the meter to respond quickly to a decreasing signal level.

The Auto Set Level option provides automatically controlled gain at the output of the distortion amplifier to compensate for a 10 dB range of input signal. For THD measurements, gain is simply controlled by the input signal level, which is the reference for the measurement. For IMD measurements, the reference for the measurement is not the input signal (total composite signal) but rather the level of the high-frequency (7 kHz) component. Yet, the input signal level indicated on the front panel meter (pk equiv v/pwr) during the measurement is proportional to the peak value of the composite signal.

For the Auto Set Level to operate over a 10 dB range of peak equivalent volt/power level, it is necessary that the SET LEVEL control be adjusted such that when in the SET LEVEL mode, the meter reads within approximately plus or minus 2 dB of the meter deflection when in the PK EQUIV V/PWR mode. This places the output of the absolute level detector in the proper range to control the auto set level circuit. Once the SET LEVEL control is properly set, no further adjustment is required unless the low-to-high frequency ratio at the analyzer input is changed. Now, the 7 kHz level (absolute value detector output) tracks the input signal level (peak detector output).

In order to avoid possible readout error due to an incorrectly adjusted SET LEVEL control, a "window" detector is incorporated in the IM analyzer. This circuit consists primarily of operational amplifiers U14 and U15. U14 turns on ADJUST light-emitting diode CR24 if the output of the absolute value detector, as divided down by resistors R68, R70 and R71, exceeds the output of the peak detector by approximately 2.5 dB. The peak

etector output is derived from the voltage developed across resistor R38. Conversely, 15 turns on the ADJUST indicator if the output of the peak detector exceeds the output f the absolute value detector, as divided down and appearing at pin 3 of U15, by pproximately 2 dB.

Operational amplifiers U16 and U17 act in a similar manner to disable the ADJUST ndicator (by absorbing the drive current through R79) if the peak equivalent volt power eading is much too low (less than 20 percent of full scale), or too high (greater than 150 ercent of full scale). Here the peak detector output is simply compared to dc levels. 4 is used to turn off the ADJUST indicator when the instrument is not in the auto mode of peration. If the auto set-level option is not installed, R79 is removed.

The reader may be interested to know that in the U17/U18 comparator circuit, diode R22 is a redundant component. If the output of U17 goes negative, it pulls the output f U16 negative through the pin 8 connections. Therefore CR22 may be used as a spare iode.

SECTION IV
MAINTENANCE

-1. INTRODUCTION

This section provides a performance check, adjustment and calibration procedures, and roubleshooting information for the IMD option.

-2. TEST EQUIPMENT

Recommended test equipment for performance checking and troubleshooting is listed in able 4-1. Test instruments other than those described can be used provided their pecifications equal or exceed those listed.

Table 4-1. Required Test Equipment

TYPE	REQUIRED SPECIFICATIONS	USE	RECOMMENDED INSTRUMENT
AC-DC DIGITAL VOLTMETER	Range: 1mV to 2V Accuracy: 0.1% ± 1 digit	Calibration	Fluke Model 8000A
Audio Generator	Frequency Range: to 8 kHz	Calibration	Sound Technology Model 1700 B or 1400A
OSCILLOSCOPE	Bandwidth: 500 kHz Defection Factor: 5 mV/div Number of Channels: 2	Calibration and Troubleshooting	Hewlett-Packard Model 1200A or Philips Model 3232

-3. PERFORMANCE CHECK

-4. INTRODUCTION

The performance check for the IMD option consists of an intermodulation residual istortion test. If the performance limits are exceeded in the following paragraph, refer o the troubleshooting hints in paragraph 4-16.

-5. INTERMODULATION RESIDUAL DISTORTION TEST

a. Connect equipment in test configuration shown in Figure 1-1 of Model 1700B manual except connect a cable from SIGNAL OUTPUT/GENERATOR OUTPUT connector of Model 1700B directly to its INPUT terminals. Set Model 1700B ADJUST control to CAL position.

b. Set IMD option controls as follows:

IM RATIO switch ----------4:1
HF ONLY pushbutton ----------out
LF ONLY pushbutton ----------out
OUTPUT ATTEN switch ----------0 dB
OUTPUT VERNIER control ----------max CW

c. Press PK EQUIV V/PWR pushbutton and set INPUT switch to 3 VOLTS range.
d. Press IMD SET LEVEL pushbutton and rotate adjacent ADJUST control for a full-scal reading on meter.
e. Press IMD pushbutton and set RATIO switch to -80 dB/.01 PERCENT range. Check tha meter reading is .0025% or less.

4-6. ADJUSTMENT AND CALIBRATION PROCEDURE

This procedure should be performed whenever the results of the performance check (Paragraph 4-3) clearly establish the need to do so. After successfully performing in sequence the procedure in Paragraphs 4-7 through 4-15, the IMD option is considered to be calibrated.

NOTE

When performing this procedure ensure that only the equipment and cables specified are connected to the instrument.

4-7. IM GENERATOR

4-8. OSCILLATOR ADJUSTMENTS

a. Set front panel controls as follows:

PK EQUIV V/PWR pushbutton ----------in
HF ONLY pushbutton ----------out
LF ONLY pushbutton ----------in
RATIO switch ----------1:1
OUTPUT VERNIER ----------max CW
OUTPUT ATTEN switch ----------0dB
FAST RESPONSE/LOW DISTORTION switch ----------Fast Response
THD ADJUST control ----------CAL

(Ignore an indicated overload condition) Remove sync from LF oscillator either by removing connection to power transformer (#7 on Generator Board) or by lifting one end of C19. Connect SIGNAL OUTPUT to a scope with horizontal sweep (5 ms/cm) synced to power line. Adjust R4 for a stationary pattern (LF oscillator running at line frequency). It may be necessary to adjust FET bias (R8) to keep oscillator running as R4 is adjusted. Restore LF osc. sync.

b. Connect a cable between SIGNAL OUTPUT connector and INPUT terminals.

LF ONLY pushbutton ----------out

c. Measure Q6 gate voltage (an easy place to measure is at C11, .033 uf.). Allowable range is 1.0 to 2.0 Vdc. If out of range, adjust R23 for a reading 1.5 Vdc. Isolate gate voltage from voltmeter probe with a 10 K ohm resistor.

d. Measure Q3 gate voltage (an easy place to measure is at collector of Q2. Don't forget 10 K isolation!). Allowable range is 1.0 to 2.0 Vdc. If out of range, adjust R8 for a reading of 1.5 Vdc.

e. Press HF ONLY pushbutton. Adjust OUTPUT VERNIER control until front panel meter reads exactly full scale.

f. Change front panel controls as follows:

HF ONLY pushbutton ----------out
LF ONLY pushbutton ----------in

g. Without changing setting of OUTPUT VERNIER control, carefully adjust R13 until front panel meter indicates same full-scale reading obtained in Step C above.

h. Repeat Step d above. If it was necessary to readjust R8, repeat Step g.

-9. 4:1 DIVIDER CONFIDENCE CHECK

a. Change front panel controls as follows:

INPUT switch ----------3V
RATIO switch ----------4:1

b. Adjust OUTPUT VERNIER (and/or R44) for a front panel meter reading as close as possible to 2.40 Vac.

c. Change front panel controls as follows:

HF ONLY pushbutton ----------in
LF ONLY pushbutton ----------out
INPUT switch ----------1 V

d. Check that front panel meter reads 0.60 $\pm$ .02 V.

10. IM ANALYZER

11. PEAK DETECTOR AND THD SIGNAL LEVEL ADJUSTMENTS

a. Connect DVM in parallel with cable connected between SIGNAL OUTPUT connector and INPUT terminals.

b. Change front panel controls as follows:

HF ONLY pushbutton ----------out
LF ONLY pushbutton ----------in

c. Adjust OUTPUT VERNIER and OUTPUT ATTEN controls (and/or R44) for DVM reading of 0.800 Vac.

d. Change front panel controls as follows:

HF ONLY pushbutton ----------out
LF ONLY pushbutton ----------out

e. Adjust R34 on IM analyzer board for an exact full-scale reading on front panel meter.

f. Change front panel controls as follows:

INPUT switch ----------3V
OUTPUT ATTEN switch ----------0 dB
OUTPUT VERNIER ----------max CW

g. Adjust R44 (IM generator board) for a full-scale reading on front panel meter.

12. ABSOLUTE VALUE DETECTOR OFFSET NULL

a. Remove input signal and set INPUT switch to 3V.

b. Connect DVM between TP4 and ground (negative end of C34).

c. Set DVM to its most sensitive range.

d. Adjust R22 for DVM reading of less than ± .003Vdc.

4-13. IMD MEASUREMENT CALIBRATION

a. Connect a cable between SIGNAL OUTPUT and the INPUT terminals with the high side of the SIGNAL OUTPUT connected to the + INPUT terminal.

b. Connect a 47 kilohm resistor to the + INPUT terminal.

c. Connect an external audio oscillator between the -INPUT terminal and the floating end of the 47 kilohm resistor.

d. Set front panel controls as follows:

PK EQUIV V/PWR ----------in
RATIO ----------1:1
HF ONLY ----------in
LF ONLY ----------out
OUTPUT ATTEN ----------0dB
INPUT ----------1 Volt Range
RATIO ---------- -40dB(1%)
THD ADJUST ----------CAL

e. Connect vertical input of oscilloscope to DISTORTION OUTPUT. Set controls as follows:

Vertical Sensitivity ----------20 mV/cm
Sweep ----------5 ms/cm
Sync ----------Internal

f. Set external audio oscillator frequency to approximately 7 kHz.

g. With output of external oscillator reduced to zero, adjust OUTPUT VERNIER for 1700B meter reading as close to exact full scale as possible.

h. Change front panel controls as follows:

OUTPUT ATTEN ----------70 dB
LF ONLY ----------in
INPUT ----------.01 volt range

Adjust output of external oscillator for a meter reading as close to exact full scale as possible.

i. Change front panel controls as follows:

LF ONLY ----------out
OUTPUT ATTEN ----------0dB
INPUT ----------3 Volt range

Adjust the frequency of the external oscillator for a 10 to 15 ms period of the sinc wave appearing on the scope.

Adjust IM SET LEVEL control for an exact full scale reading on the meter.

j. Depress IMD pushbutton. Adjust R63 on the IM Analyzer board for an exact full scale reading.

-14. AUTO SET LEVEL ADJUSTMENT

a. Turn THD ADJUST control to AUTO position. Adjust R6 on the auto set level board for an exact full-scale (1.00%) reading.

b. Switch INPUT switch to 10 volt range. Check that reading is 1.00 ± .02%.

-15. TROUBLESHOOTING

Before attempting to troubleshoot the IMD Option ensure that the fault is with the ption and not caused by the test setup or associated equipment. The performance check Paragraph 4-3) enables this to be determined without having to remove the covers.

If an abnormal condition is observed during the performance check, table 4-2 will uggest remedies. However, before proceeding with detailed troubleshooting, note the roubleshooting hints contained in paragraph 3-29 of the Model 1700B Manual.

-16. SYMPTOM/CAUSE TABLE

Table 4-2 contains symptoms of IMD option malfunctions and provides diagnostic tests or the location of these faults. Following the repair of a defective component, refer o paragraph 4-1 for instructions regarding any necessary calibration and/or adjustment rocedures.

Table 4-2. IMD Symptom-Cause Table

Symptom	Probable Cause	Diagnostic Test
normally high vel of residual l distortion, stortion product random noise.	7 kHz oscillator amplitude instability, Q6 gate voltage out of adjustment.	Measure dc level at gate of Q6 on IM analyzer board. Reading should be between 1.0 and 2.0 Vdc.
normally high vel of residual l distortion, stortion product multiple of 60-Hz	(1) Nonlinearity in IM generator summing amplifier U3, IM analyzer buffer U1. (2) Nonlinearity in THD buffers U101, U102, U103.	(1) Replace U3, U1. (2) Replace U101, U102, U103
plitude of 60-Hz cillator is stable, or cillator is not nced to line.	Q3 gate voltage out of adjustment.	Measure dc level of gate of Q3 on IM generator board. Reading should be between 1.0 and 2.0 Vdc. Check freq. adjustment per 4-8a.

-17. COMPONENT REPLACEMENT - CALIBRATION AND ADJUSTMENT

If U1 or U2 in the generator section are replaced, do the oscillator adjustments, ection 4-8. In general, changing IC's in the analyzer section do not require re-adjustment. he exception is U6 in the Absolute Value Detector. Changing U6 would require the zero djustment at TP4, section 4-12.

-18. ACCESS TO LOW-DISTORTION OSCILLATOR

In order to reach the low-distortion oscillator assembly, it is necessary to move the M analyzer board mounted above it. To reach the oscillator, proceed as follows:

a. Remove top cover from instrument.

b. Locate metal shield on which IM analyzer board is mounted.

c. Remove four screws attaching this shield to instrument. Do not remove screws securing IM analyzer board to shield.

d. Carefully move shield back until pushbuttons on board clear rear of front panel.

e. Move shield until it is located vertically above center of instrument. Insert upper edge of instrument's center divider into slot on edge of IM analyzer shiel This holds board in a position that permits access to oscillator.

f. Replace IM analyzer board following reverse procedure.

SECTION V
MODIFICATIONS FOR EUROPE AND JAPAN

5-1. DIN (EUROPE)

a. The Low Frequency Oscillator is set at 250 Hz and is not synchronized with the power line. The High Frequency Oscillator is at 8 kHz. The IM measurement then conforms to DIN 45403, Page 4 - "Measurement of non-linear distortion in electroacoustics; intermodulation method", and DIN 45500, Page 6 - "Hi-Fi techniques, requirements for amplifiers".

A scope sync (250 Hz) is available at a BNC connector on the rear panel.

The Passive, High-Pass Filter has been changed to have a cut-off frequency of 3.9 kHz.

The Low-Pass Filter has been changed to have a cut-off frequency of 1.25 kHz.

b. The following parts have been changed:

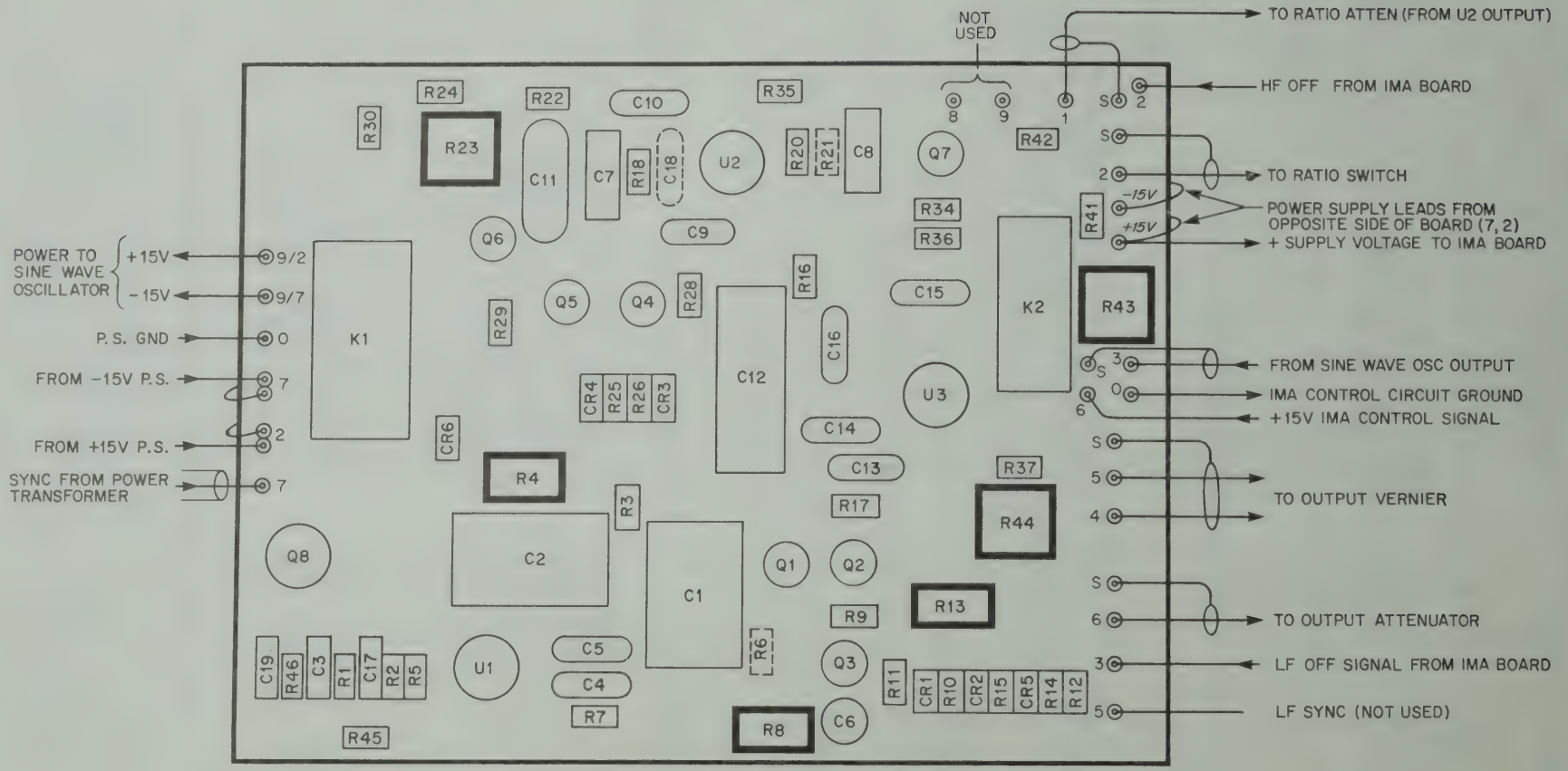
Reference Designators	Description	Stock No.	Qty.
IM Analyzer Board			
C1, C2	.02 uf, 1%, 33V, plystr	2025-0004	2
C3, C4	.0068 uf, 2.5%, 63V, plystr	2025-0016	2
C32	.0082 uf, 1%, 33V, plystr	2025-0002	1
C37	.082 uf, 1%, 33V, plystr	2025-0005	1
C36	.0033 uf, 2.5%, 63V, plystr	2025-0014	1
C36A	680 pf, 2.5%, 63V, plystr	2025-0019	1
R46, 47, 48, 49	5.23 K, 1%, 1/8W, MF	1015-1523	4
IM GENERATOR BOARD			
C1, C2	.022 uf, 2.5%, 63V, plystr	2025-0029	2
R18, 20	10K, .25%, 1/8W, MF	1005-2100	2
R17	10K, 1%, 1/8W, MF	1015-2100	1
R16	52.3K, 1%, 1/8W, MF	1015-2523	1
R3, 5	28.7K, 1%, 1/8W, MF	1015-2287	2

c. Also, the following changes or additions have been made:

1. Replace R4 (5K trim-pot) with a jumper.
2. Remove R2 (15K, 5%, 1/4W) from board.
3. Remove sync cable to IM generator Board (pad 7).
4. Add shielded cable between pad 5 on generator board and BNC scope sync connector on rear panel.

5-2. 50/60 Hz OPERATION (JAPAN)

The Low Frequency Oscillator is set to 60 Hz and is free-running. A scope sync is available at a BNC connector on the rear panel. Sections 5-1-C-2,3,4 above are applicabl



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IM GENERATOR BOARD

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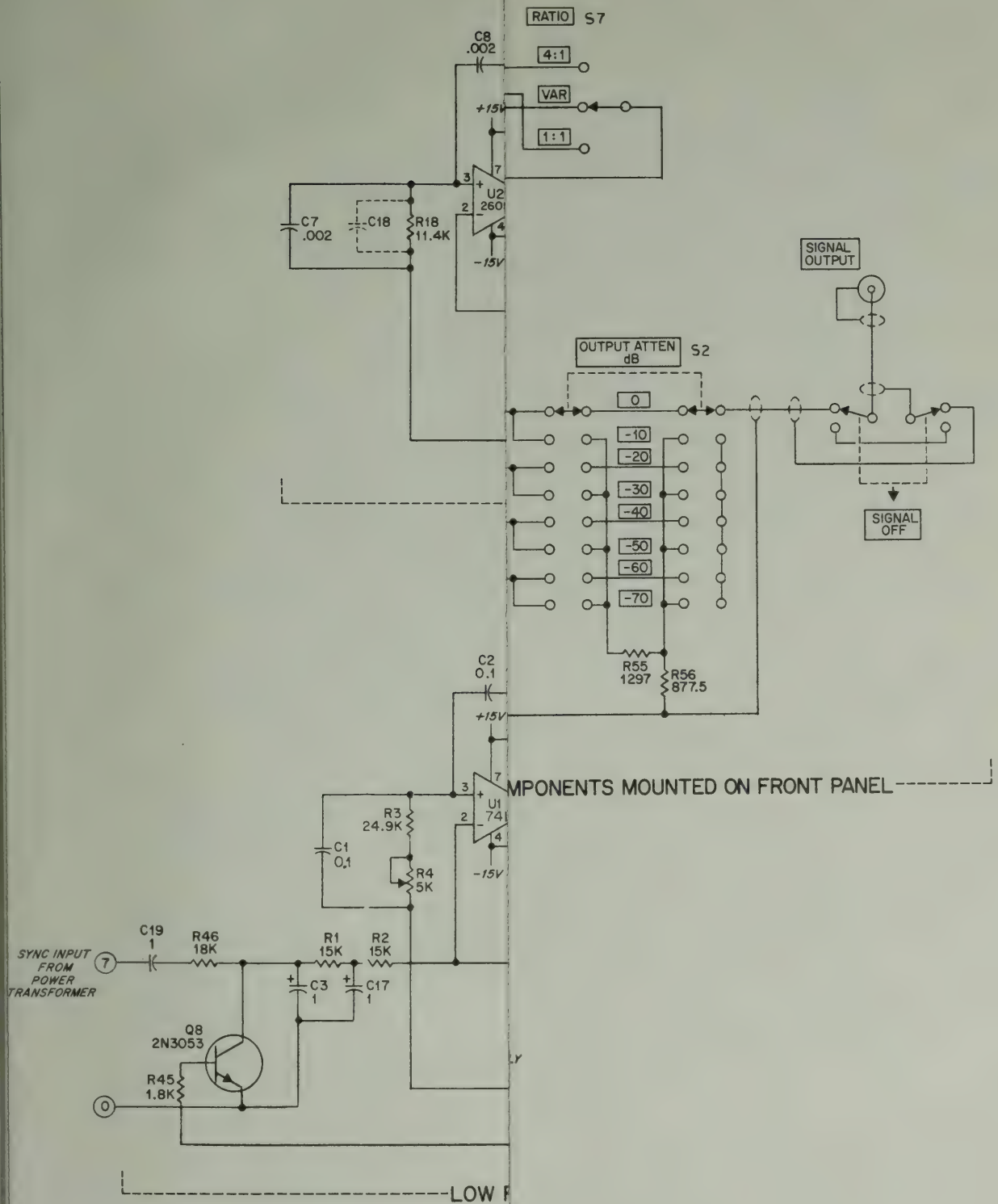

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IM GENERATOR BOARD

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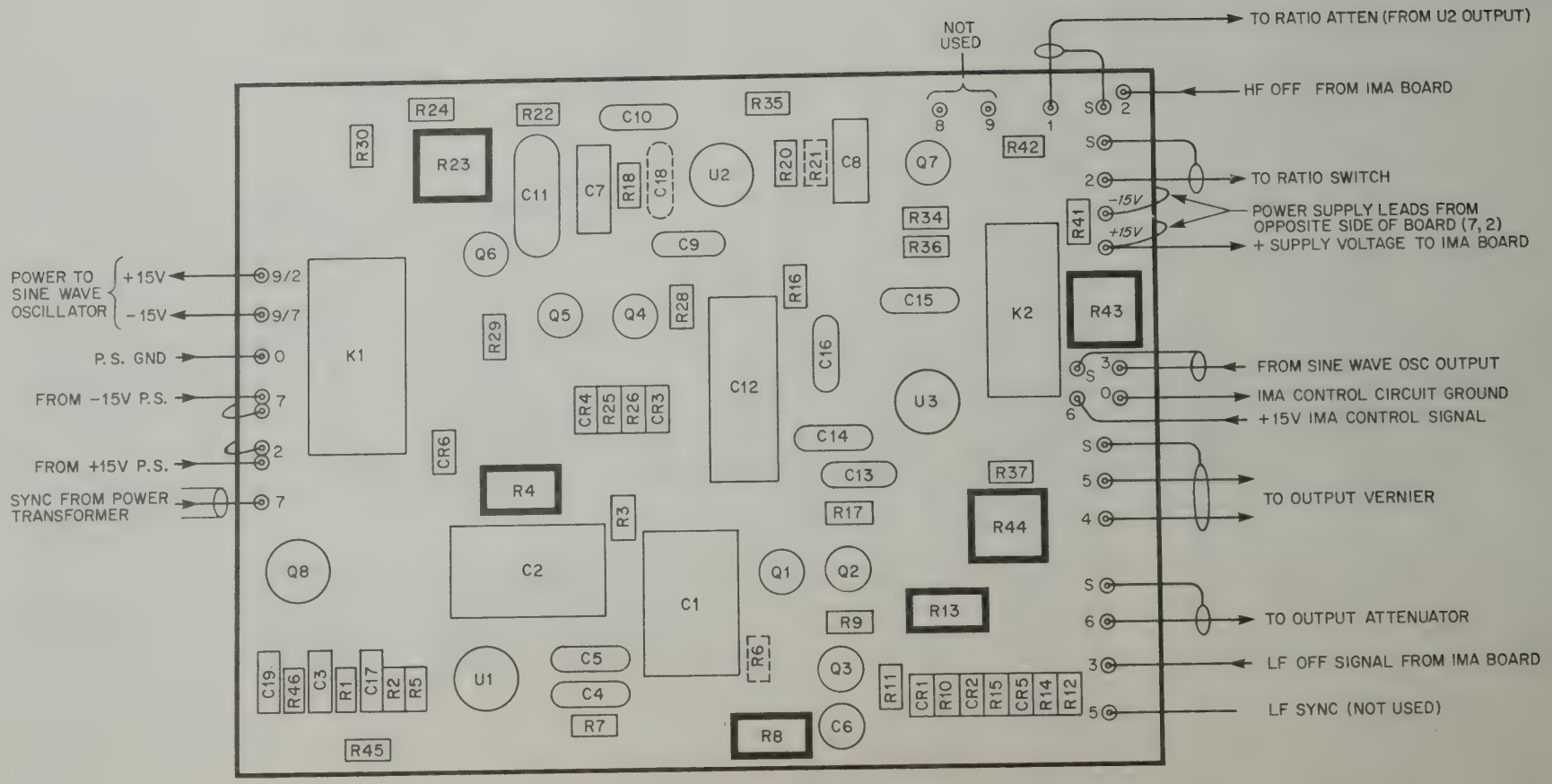

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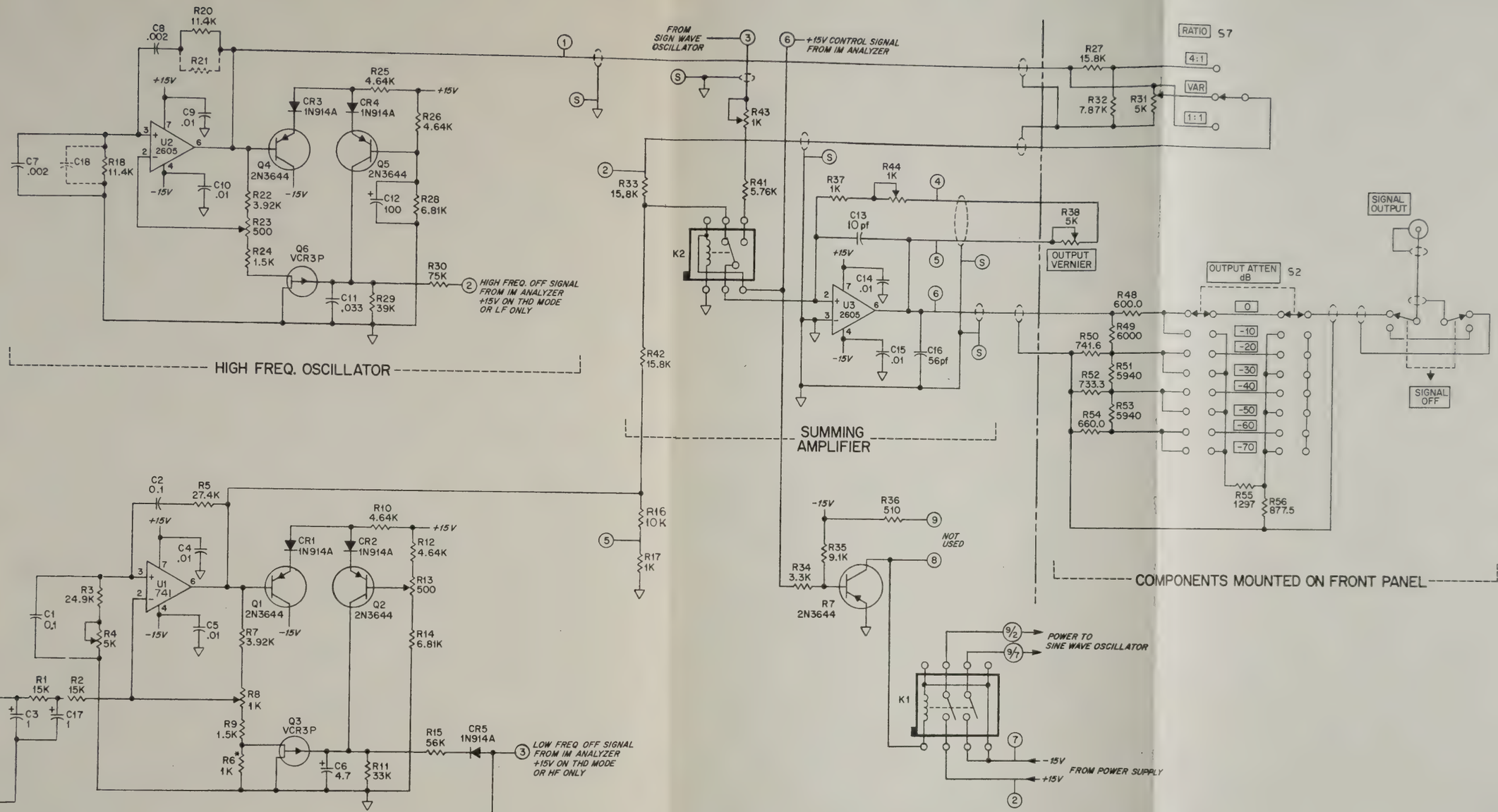
IM GENERATOR BOARD 4/76



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IM GENERATOR BOARD

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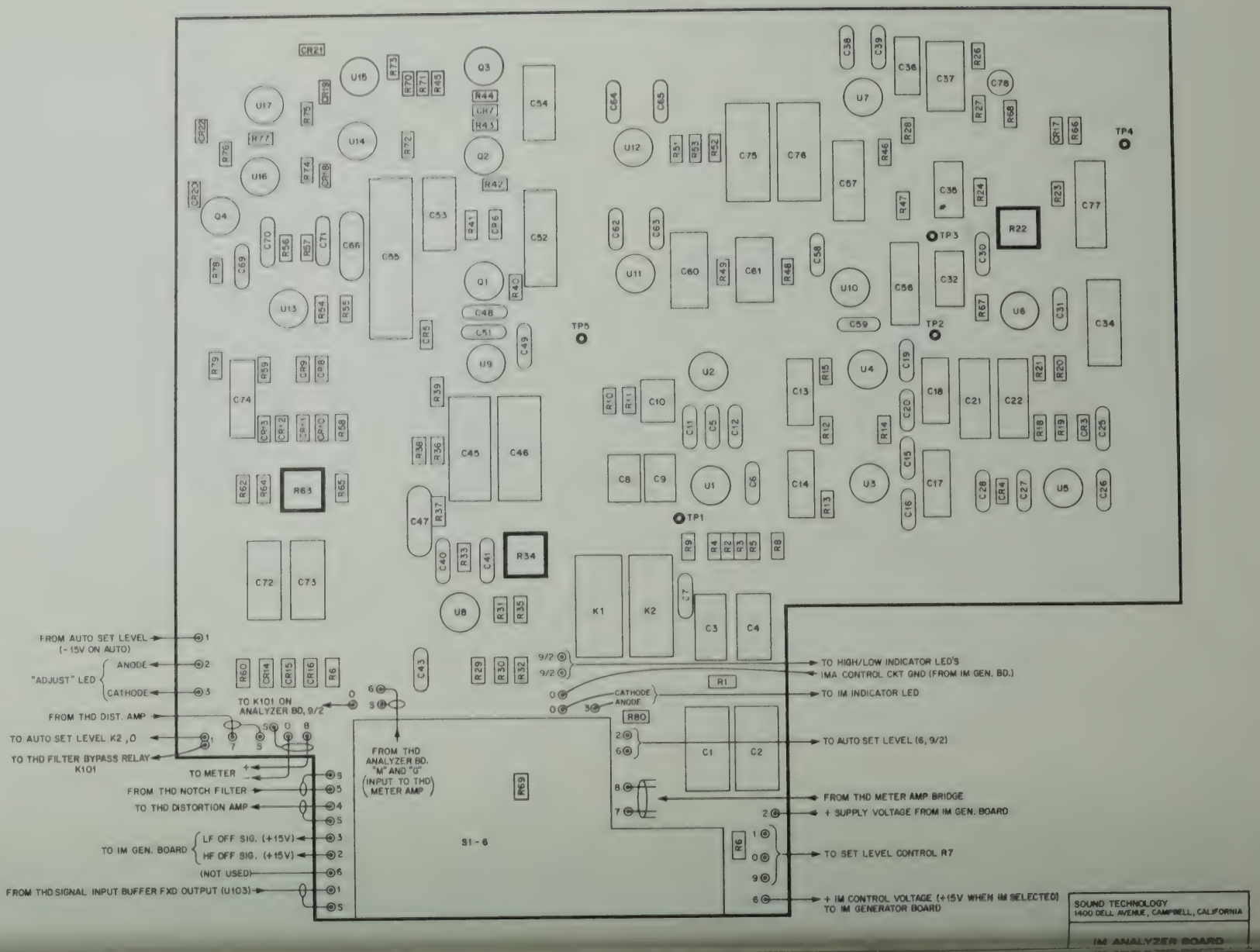
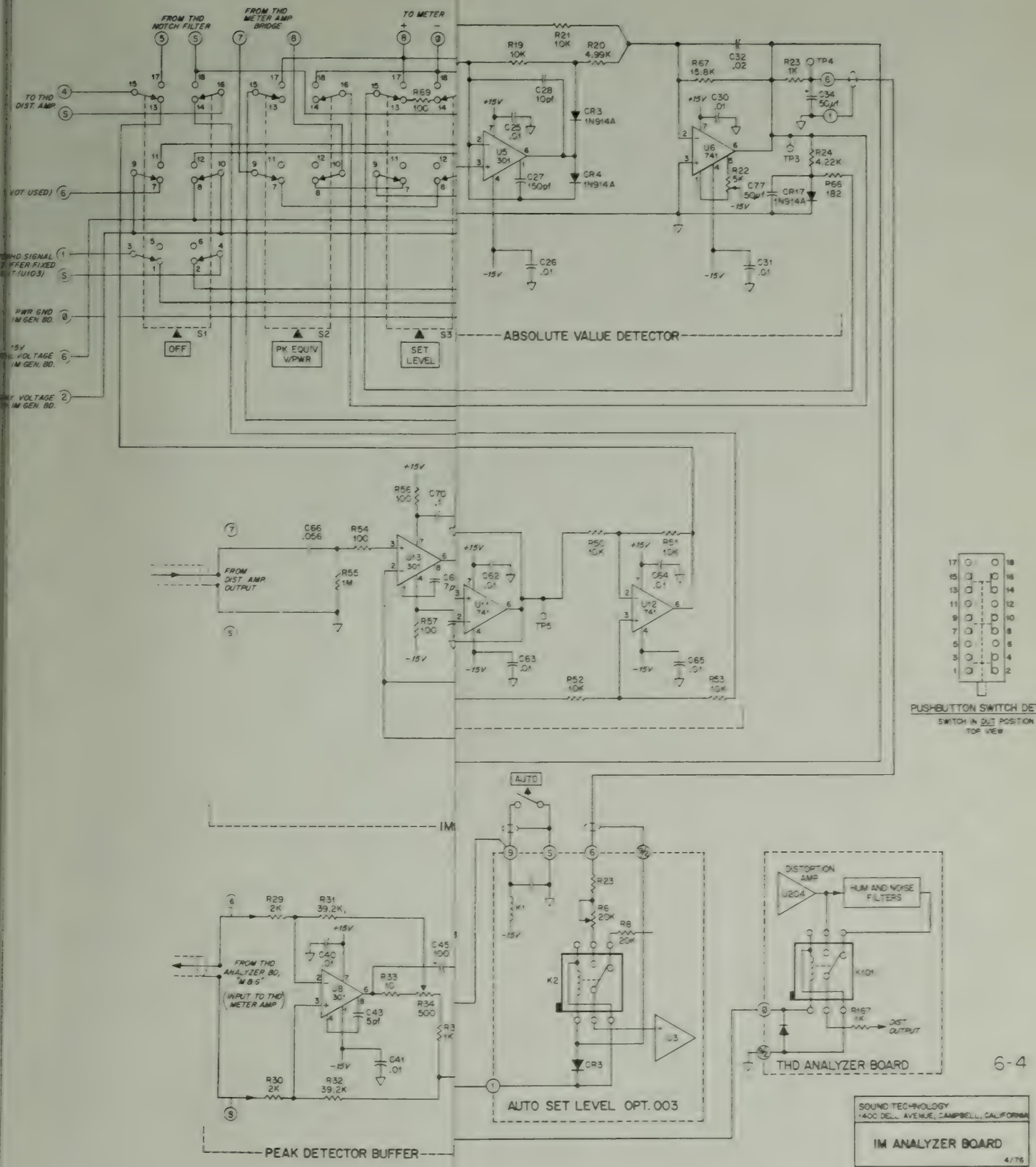

FROM AUTO SET LEVEL (-15V ON AUTO)
"ADJUST" LED
ANODE
CATHODE
FROM THD DIST. AMP
TO AUTO SET LEVEL K2 ,O
TO THD FILTER BYPASS RELAY K101
TO METER
FROM THD NOTCH FILTER
TO THD DISTORTION AMP
TO IM GEN. BOARD
LF OFF SIG. (+15V)
HF OFF SIG. (+15V)
(NOT USED)
FROM THD SIGNAL INPUT BUFFER FXD OUTPUT (U103)
TO K101 ON ANALYZER BD, 9/2
FROM THD ANALYZER BD. "M" AND "G" (INPUT TO THD) METER AMP
S1-6
TO HIGH/LOW INDICATOR LED'S
IMA CONTROL CKT GND (FROM IM GEN. BD.)
TO IM INDICATOR LED
CATHODE
ANODE
TO AUTO SET LEVEL (6, 9/2)
FROM THD METER AMP BRIDGE
+ SUPPLY VOLTAGE FROM IM GEN. BOARD
TO SET LEVEL CONTROL R7
+ IM CONTROL VOLTAGE (+15V WHEN IM SELECTED) TO IM GENERATOR BOARD
SOUND TECHNOLOGY
1400 DELL AVENUE, CAMPBELL, CALIFORNIA
IM ANALYZER BOARD


FROM THD NOTCH FILTER
FROM THD METER AMP BRIDGE
TO METER
TO THD DIST. AMP.
S1
OFF
S2
PK. EQUIV W/PWR
S3
SET LEVEL
ABSOLUTE VALUE DETECTOR
FROM DIST. AMP. OUTPUT
TP5
PUSHBUTTON SWITCH DETAIL
SWITCH IN OUT POSITION
TOP VIEW
AUTO
IM
FROM THD ANALYZER BD. "M B S"
(INPUT TO THD METER AMP)
AUTO SET LEVEL OPT. 003
DISTORTION AMP
HUM AND NOISE FILTERS
THD ANALYZER BOARD
PEAK DETECTOR BUFFER
SOUND TECHNOLOGY
1400 DELL AVENUE, CAMPBELL, CALIFORNIA
IM ANALYZER BOARD
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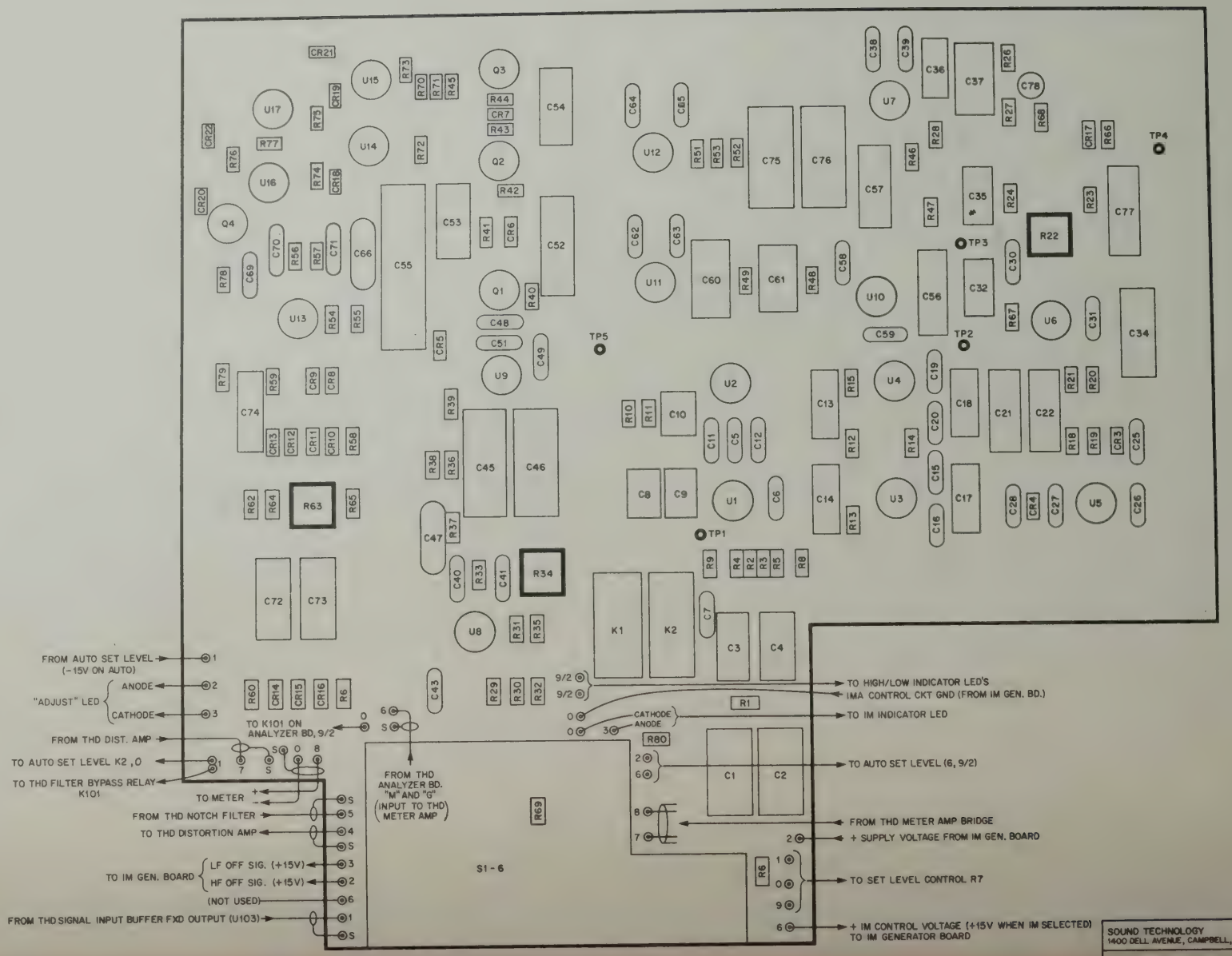
FROM AUTO SET LEVEL (-15V ON AUTO)
"ADJUST" LED
ANODE
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TO THD DISTORTION AMP
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LF OFF SIG. (+15V)
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FROM THD ANALYZER BD. "M" AND "G" (INPUT TO THD METER AMP)
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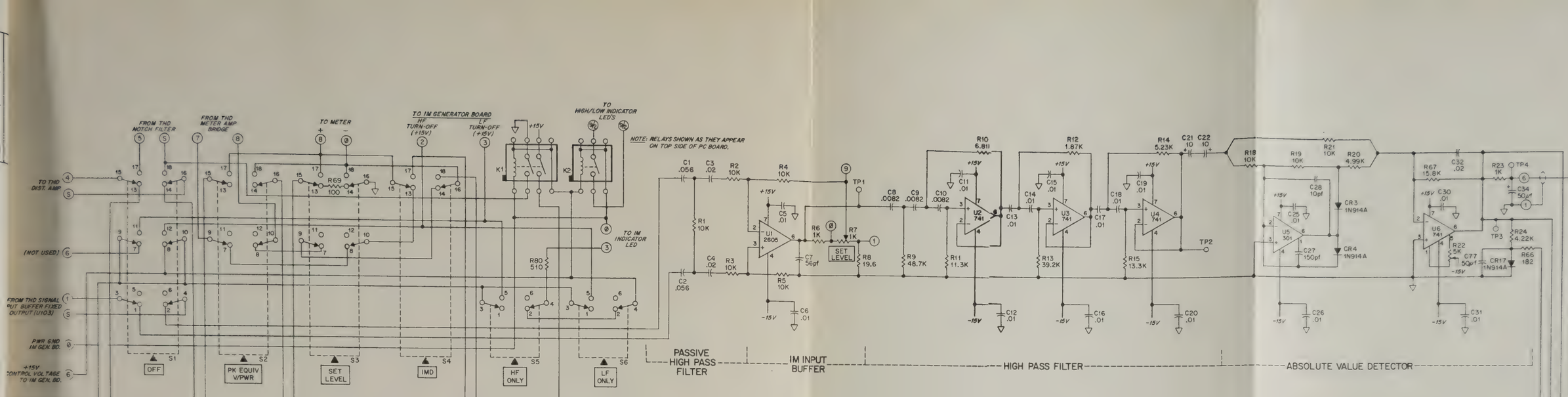
TO HIGH/LOW INDICATOR LED'S
IMA CONTROL CKT GND (FROM IM GEN. BD.)
TO IM INDICATOR LED
TO AUTO SET LEVEL (6, 9/2)
FROM THD METER AMP BRIDGE
+ SUPPLY VOLTAGE FROM IM GEN. BOARD
TO SET LEVEL CONTROL R7
+ IM CONTROL VOLTAGE (+15V WHEN IM SELECTED) TO IM GENERATOR BOARD
TP1
TP2
TP3
TP4
TP5
R22
R63
R34
K1
K2
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
Q1
Q2
Q3
Q4
C54
C55
C52
C53
C57
C60
C61
C56
C74
C45
C46
C72
C73
C1
C2
C3
C4
R6
R80
R69
SOUND TECHNOLOGY
1400 DELL AVENUE, CAMPBELL, CALIFORNIA
IM ANALYZER BOARD



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SOUND TECHNOLOGY
1400 DELL AVENUE, CAMPBELL, CALIFORNIA

IM ANALYZER BOARD

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SECTION VII
SPARE PARTS

. INTRODUCTION

This section contains information for ordering replacement parts, and provides the lowing details:

a. Sound Technology part number.
b. Circuit diagram reference designator.
c. Description of part.
d. Total quantitites used.

. ORDERING INFORMATION

When ordering replacement parts, each part must be identified by a Sound Technology t number. To order a part, include the following information:

a. Instrument model number.
b. Instrument serial number.
c. Description of part.
d. Function and location of part.

Address your order or inquiry to:

Sound Technology
1400 Dell Avenue
Campbell
California, 95008
(408)378-6540

1700B DISTORTION ANALYZER OPTION 004

PURCHASED PARTS

PART NO	DESCRIPTION	QTY
0300-0000	DIODE-LED RED CR24,25	2.0
1005-1787	RES-FXD 7.87K 0.25% 1/8W MF R32	1.0
1005-2158	RES-FXD 15.8K 0.25% 1/8W MF R27	1.0
1400-0010	RES-VAR 5K 10% MOD. LOG,CARBON R31	1.0
1400-0011	RES-VAR 5K 10% LINEAR CARBON R38	1.0
1400-0012	RES-VAR 1K 10% CON MOD.LOG,CAR R7	1.0
3005-0003	SWITCH-SLIDE DP3T MINIATURE S7	1.0
7900-0009	MANUAL-IMA OPTION	1.0
8000-0000	PUSHBUTTON-WHITE	6.0
8000-0006	KNOB-ROUND 1/2 OD,1/8 ID BEIGE	3.0
8000-0011	KNOB-1/2 DIA, 1" SKIRT, BEIGE	1.0
01700-1029	SHIELD-IM ANALYZER	1.0
01700-1030	BRACKET-REAR IM	1.0
01700-1032	TRIM PLATE-IMA	1.0
01700-1033	SWITCH PLATE-IMA	1.0
01700-30017	ASSY-PC, IM ANALYZER	1.0
01700-30018	PC-ASSY IM SIGNAL GENERATOR	1.0
01700-30021	ATTEN SWITCH ASSEMBLY, IM OPT	1.0

01700-30017 ASSY-PC, IM ANALYZER

PART NO	DESCRIPTION	QTY
0005-0000	TRANS 2N3053 NPN SI Q1-4	4.0
0100-0001	IC-OP AMP 741 U2,3,4,6,7,10,11,12	8.0
0100-0014	IC-OP AMP 2605 GRADE 6 BLUE U1,9	2.0
0100-0016	OP-AMP 301C U5,8,13-17	7.0
0200-0000	DIODE-GEN 1N914A SI CR3-5,7-22	19.0
0205-0002	DIODE-ZENER 1N750 4.7V CR6	1.0
1015-0010	RES-FXD 10 1% 1/8W MF R33,64,65	3.0
1015-0019	RES-FXD 19.6 1% 1/8W MF R8	1.0
1015-0182	RES-FXD 182 1% 1/8W MF R66	1.0
1015-1100	RES-FXD 1K 1% 1/8W MF R6,23,35,36,77	5.0
1015-1187	RES-FXD 1.87K 1% 1/8W MF R12	1.0
1015-1200	RES-FXD 2K 1% 1/8W MF R29,30	2.0
1015-1232	RES-FXD 2.32K 1% 1/8W MF R38	1.0
1015-1301	RES-FXD 3.01K 1% 1/8W R75	1.0
1015-1422	RES-FXD 4.22K 1% 1/8W MF R24	1.0
1015-1499	RES-FXD 4.99K 1% 1/8W MF R20	1.0
1015-1523	RES-FXD 5.23K 1% 1/8W MF R14	1.0
1015-1681	RES-FXD 6.81K 1% 1/8W MF R10	1.0
1015-1715	RES-FXD 7.15K 1% 1/8W MF R27,28	2.0
1015-1953	RES-FXD 9.53K 1% 1/8W R70,72	
1015-2100	RES-FXD 10K 1% 1/8W MF R1-5,18,19,21,50-53,74	
1015-2113	RES-FXD 11.3K 1% 1/8W MF R11	
1015-2130	RES-FXD 13.0K 1% 1/8W MF R46-49	
1015-2133	RES-FXD 13.3K 1% 1/8W MF R15	
1015-2158	RES-FXD 15.8K 1% 1/8W MF R67	
1015-2261	RES-FXD 26.1K 1% 1/8W MF R71	
1015-2316	RES-FXD 31.6K 1% 1/8W MF R76	
1015-2365	RES-FXD 36.5K 1% 1/8W R73	
1015-2374	RES-FXD 37.4K 1% 1/8W MF R68	
1015-2392	RES-FXD 39.2K 1% 1/8W MF R13,31,32	
1015-2487	RES-FXD 48.7K 1% 1/8W MF R9	
1100-0022	RES-FXD 22 5% 1/4W R62	
1100-0027	RES-FXD 27 5% 1/4W R41	
1100-0091	RES-FXD 91 5% 1/4W R60,61	
1100-0100	RES-FXD 100 5% 1/4W R54,56,57,69	
1100-0510	RES-FXD 510 5% 1/4W R45,80	
1100-1100	RES-FXD 1K 5% 1/4W R40,42,58,78,79	
1100-1330	RES-FXD 3.3K 5% 1/4W R39	
1100-2100	RES-FXD 10K 5% 1/4W R44	
1100-2330	RES-FXD 33K 5% 1/4W R43	
1100-2470	RES-FXD 47K 5% 1/4W R37	
1100-3100	RES-FXD 100K 5% 1/4W R26	
1100-4100	RES-FXD 1M 5% 1/4W R55,59	
1410-0001	RES-VAR 100 TRIMPOT CERMET R63	
1410-0002	RES-VAR 500 TRIMPOT CERMET R34	
1410-0004	RES-VAR 5K TRIMPOT CERMET R22	
2000-0005	CAP-FXD 5PF 10% 500V MICA C43	
2000-0007	CAP-FXD 7PF 5% 500V MICA C69	
2000-0010	CAP-FXD 10PF 5% 500V MICA C28	
2000-0056	CAP-FXD 56PF 5% 500V MICA C7,51	
2000-0150	CAP-FXD 150PF 5% 500V MICA C27,50	
2000-0470	CAP-FXD 470PF 5% 500V MICA C47	
2020-0002	CAP-FXD 0.056UF 10% 100V MYLAR C66	
2025-0002	CAP-FXD 0.0082UF 1% 33V PLYSTR C8-10	
2025-0003	CAP-FXD 0.01UF 1% 33V PLYSTR C13,14,17,18,36	

NO	DESCRIPTION	QTY
-0004	CAP-FXD 0.02UF 1% 33V PLYSTR C3,4,32	3.0
-0007	CAP-FXD 0.2UF 1% 100V FILM C37	1.0
-0010	CAP-FXD .039UF 2.5% 33V PLYSTR C57	1.0
-0015	CAP-FXD .015UF 2.5% 63V PLYSTR C56	1.0
-0017	CAP-FXD .056UF 2.5% 33V PLYSTR C1,2	2.0
-0029	CAP-FXD .022UF 2.5% 63V PLYSTR C60	1.0
-0030	CAP-FXD .027UF 2.5% 63V PLYSTR C61	1.0
-0000	CAP-FXD 0.01UF 100V CERAMIC C5,6,11,12,15,16,19,20,25,26,30, 31,38-41,48,49,58,59,62-65	24.0
-0002	CAP-FXD 0.1UF 25V CERAMIC C70,71	2.0
-0000	CAP-FXD 4.7UF 10% 35V TANT C78	1.0
-0001	CAP-FXD 1UF 25V ELECT AL C35	1.0
-0003	CAP-FXD 10UF 25V ELECT AL C21,22,74	3.0
-0004	CAP-FXD 35UF 25V ELECT AL C53,54,72,73	4.0
-0005	CAP-FXD 50UF 25V ELECT AL C34,77	2.0
-0006	CAP-FXD 100UF 25V ELECT AL C45,46,52,75,76	5.0
-0019	CAP-FXD 800UF 6V ELECT C55	1.0
-0007	SWITCH-PB,4 STA 6P & 2 STA P-P S1-6	1.0
-0000	SOCKET-IC 8 PIN ROUND	17.0
-0000	CONN-SINGLE CONTACT,.093 PIN	21.0
-5000	CONN-SINGLE CONTCT,.093 SOCKET	21.0
-0002	SPACER-PUSHBUTTON SW, DOGBONE	6.0
-0002	RELAY-1 FORM A K2	1.0
-0003	RELAY-2 FORM A K1	1.0
-0000	PUSHBUTTON-WHITE	6.0
-5017	PC BOARD-IM ANALYZER	1.0

P80-80018 PC-ASSY
SIGNAL GENERATOR

NO	DESCRIPTION	QTY
0001	TRANS 2N3644 PNP SI Q1,2,4,5,7	5.0
0000	TRANS 2N3053 NPN SI Q8	1.0
0001	TRANS-FET VCR3P P-CHAN Q3,6	2.0
0001	IC-OP AMP 741 U1	1.0
0007	IC-OP AMP 2605 GRADE 2 RED U3	1.0
0014	IC-OP AMP 2605 GRADE 6 BLUE U2	1.0
0000	DIODE-GEN 1N914A SI CR1-6	6.0
2114	RES-FXD 11.4K 0.25% 1/8W MF R18,20	2.0
2158	RES-FXD 15.8K 0.25% 1/8W MF R33,42	2.0
1100	RES-FXD 1K 1% 1/8W MF R17,37	2.0
1150	RES-FXD 1.5K 1% 1/8W MF R9,24	2.0

PART NO	DESCRIPTION	QTY
1015-1392	RES-FXD 3.92K 1% 1/8W MF R7,22	2.0
1015-1464	RES-FXD 4.64K 1% 1/8W MF R10,12,25,26	4.0
1015-1576	RES-FXD 5.76K 1% 1/8W MF R41	1.0
1015-1681	RES-FXD 6.81K 1% 1/8W MF R14,28	2.0
1015-2100	RES-FXD 10K 1% 1/8W MF R16	1.0
1015-2249	RES-FXD 24.9K 1% 1/8W MF R3	1.0
1015-2274	RES-FXD 27.4K 1% 1/8W MF R5	1.0
1100-0510	RES-FXD 510 5% 1/4W R36	1.0
1100-1100	RES-FXD 1K 5% 1/4W R6	1.0
1100-1180	RES-FXD 1.8K 5% 1/4W R45	1.0
1100-1330	RES-FXD 3.3K 5% 1/4W R34	1.0
1100-1910	RES-FXD 9.1K 5% 1/4W R35	1.0
1100-2150	RES-FXD 15K 5% 1/4W R1,2	2.0
1100-2180	RES-FXD 18K 5% 1/4W R46	1.0
1100-2330	RES-FXD 33K 5% 1/4W R11	1.0
1100-2390	RES-FXD 39K 5% 1/4W R29	1.0
1100-2560	RES-FXD 56K 5% 1/4W R15	1.0
1100-2750	RES-FXD 75K 5% 1/4W R30	1.0
1410-0002	RES-VAR 500 TRIMPOT CERMET R23	1.0
1410-0003	RES-VAR 1K TRIMPOT CERMET R43,44	2.0
1410-0008	RES-VAR 1K TRIMPOT, STANDUP R8	1.0
1410-0009	RES-VAR 500 TRIMPOT, STANDUP R13	1.0
1410-0010	RES-VAR 5K TRIMPOT, STANDUP R4	1.0
2000-0010	CAP-FXD 10PF 5% 500V MICA C13	1.0
2000-0056	CAP-FXD 56PF 5% 500V MICA C16	1.0
2020-0013	CAP-FXD 0.033UF 10% 100V MYLAR C11	1.0
2025-0001	CAP-FXD 0.002UF 1% 33V PLYSTR C7,8	2.0
2025-0006	CAP-FXD 0.1UF 1% 33V PLYSTR C1,2	2.0
2040-0000	CAP-FXD 0.01UF 100V CERAMIC C4,5,9,10,14,15	6.0
2100-0000	CAP-FXD 4.7UF 10% 35V TANT C6	1.0
2100-0006	CAP-FXD 100UF 25V ELECT AL C12	1.0
2100-0020	CAP-FXD 1UF 50V ELECT TANT AXL C3,17,19	3.0
3105-0000	SOCKET-IC 8 PIN ROUND	3.0
3400-0001	RELAY-1 FORM C K2	1.0
3400-0003	RELAY-2 FORM A K1	1.0
8540-0004	SCREW 6-32 X 1/4 POZI PAN HD	2.0
8542-0001	LOCKWASHER-EXT #6	2.0
8702-0002	SPACER-THD,6-32 3/8LG X 5/160D	2.0
01700-5018	PC BOARD-IM OSCILLATOR	1.0

01700-30021 ATTEN SWITCH ASSEMBLY

PART NO	DESCRIPTION	QTY
1000-0005	RES-FXD 600.0 .1% 1/10 T2 R48	1.0
1000-0006	RES-FXD 660.0 .1% 1/10 T2 R54	1.0
1000-0007	RES-FXD 733.3 .1% 1/10 T2 R52	1.0
1000-0008	RES-FXD 741.6 .1% 1/10 T2 R50	1.0
1000-0009	RES-FXD 877.5 .1% 1/10 T2 R56	1.0
1000-0010	RES-FXD 1.297K 0.1% 1/10W MF R55	1.0
1000-0011	RES-FXD 5.940K 0.1% 1/10W MF R51,53	2.0
1000-0012	RES-FXD 6.000K 0.1% 1/10W MF R49	1.0
3010-0005	SWITCH-ROTARY IM ATTEN S2	1.0

PRICE: $ 5.00

USER'S MANUAL

MODEL 1700B* OPTION 003
AUTOMATIC SET-LEVEL

SOUND TECHNOLOGY

SOUND TECHNOLOGY
1400 Dell Avenue
Campbell, CA 95008
U.S.A.
(408) 378-6540
*Patents Pending

June, 1975

MODELS 1700B/1710B
Option 003

DISTORTION MEASUREMENT SYSTEM

WITH AUTOMATIC SET LEVEL

Your system will be even faster and easier to use with automatic set level.

AUTOMATIC SET LEVEL SIMPLIFIES:

- Distortion vs. Power or Voltage Measurements
- Distortion vs. Frequency Measurements
- IHF Sensitivity Measurements in Tuners
- Distortion at Clipping Measurement in Amplifiers
- Finding the 3% Distortion Level in Tape Recorders

SOUND TECHNOLOGY

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

Specifications

Model 1700B specifications apply with the following additions:

Capture Range: 10 dB. INPUT switch must be set for meter reading in upper 2/3 scale in VOLTS/POWER function.

Harmonic Accuracy: Add to 1700B specification

Fundamental Frequency	2nd through 5th Harmonic Accuracy
10 Hz – 20 kHz	± .2 dB
20.1 kHz – 50 kHz	± .5 dB
50.1 kHz – 110 kHz	± 1 dB

Noise: (worst case with 80 kHz filter in) .007% to 20 kHz with the measured signal greater than 0.3 vrms. Noise decreases to the standard 1700B specification as input voltage approaches full scale. Automatic Set Level can be disabled to reduce noise for high resolution readings.

All prices f.o.b. Campbell, California — data subject to change without notice.

Printed in U.S.A. 1/76

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OPERATING PROCEDURE

a. Complete normal signal connections to the amplifier under test as described on page 1-3 of 1700A Manual.

b. Rotate the ADJUST Control fully counter-clock wise, past the CAL position, until a click is heard. This activates the auto-set-level circuitry.

c. Select VOLTS/POWER function and adjust INPUT range switch so that the voltage (or power) reading is obtained with the meter pointer in the upper two-thirds of meter scale. (Levels lower than 1/3 and much greater than full-scale will cause errors in distortion readings.)

d. Select DISTORTION function and take the distortion reading in the usual manner.

NOTE

1. The overload light will glow whenever the VOLTS/POWER meter is being overloaded by more than 10% during distortion measurements. It is meant to inform the operator to up-range (advance the INPUT switch) while monitoring the distortion figure.

NOTE

2. It is normal for the residual noise to increase slightly with the Auto-Set-Level circuit in operation. The error in distortion reading due to this noise is, in general, insignificant when the distortion figure is .02% or greater.

PRINCIPLES OF OPERATION

The signal input to the Notch Filter (or the variable output of Buffer) is fed to the AC to DC Converter (U1, U2). The DC signal out of this converter, which is directly proportional to the Notch Filter input signal level, is in turn driving a Voltage to Current Converter (U3), which regulates the controlling current to the Multiplier. The Multiplier is used as a variable gain amplifier (gain range from 1 to 3.16). Its gain is inversely proportional to the controlling current and the magnitude of the AC signal to the Notch Filter.

In the manual distortion-measurement mode, whenever the input signal is below full-scale (but more than 1/3 on VOLTS scale), Buffer Amplifier gain has to be increased with the use of the ADJUST control to make up for the lower amplitude. In the automatic mode, the distortion signal level is increased to exactly the required amount through the Multiplier before it goes to the AC meter. The net effect is the same as increasing the Buffer Amplifier gain, and the distortion readings obtained in this manner will always be accurate.

Since the Multiplier is precessing signals after the Notch Filter, it is not adding distortion to the signal being analyzed. As a matter of fact, this scheme actually reduces the residual distortion noticably above 50 kHz when the input signal is significantly below full-scale. However, there is some degradation of signal-to-noise ratio whenever the Notch Filter is operating with a smaller signal.

PERFORMANCE CHECK FOR

AUTO-SET-LEVEL OPTION

a. Connect cable between SIGNAL OUTPUT BNC connecter and INPUT terminals.

b. Set Model 1700A controls as follows:

SIGNAL COMMON switch	⏚
INPUT switch	1V
ADJUST control	CAL
FUNCTION	VOLTS/POWER
FAST RESPONSE/LOW DISTORTION Switch	FAST RESPONSE
FREQUENCY pushbuttons	X100, 10 (1 kHz)
FILTERS pushbuttons	80 kHz

c. Adjust OSCILLATOR LEVEL control for .95V rms as indicated on meter.

d. Depress SET LEVEL pushbutton and rotate ADJUST control until meter pointer is exactly over SET LEVEL mark.

e. Depress DISTORTION pushbutton and set RATIO switch to proper range (.03% or .1%) to obtain a good reading (meter pointer in upper 2/3's of meter scale). Note this distortion reading.

f. Now, rotate the ADJUST control counter-clockwise until a "click" is heard. (• AUTO position).

g. Note distortion reading on meter. This reading should be the same as the one noted in step e with an error no greater than 2 minor divisions on the 0-1 scale.

h. Change INPUT switch to 3V range (set level is now reduced by 10 dB) and note distortion reading on meter. This reading should be the same as the one noted in step e with an error no greater than 2 minor division on the 0-1 scale.

i. Set FREQUENCY pushbuttons to X1000, 100 (100 kHz) and OSCILLATOR LEVEL control fully CW (Maximum output).

j. With 80 kHz FILTER turned off, manually SET LEVEL to obtain distortion reading. Note this reading on dB meter scale.

k. Rotate the ADJUST control counter-clockwise until a "click" is heard. Note the distortion reading on dB meter scale. This reading should agree with the one obtained in step j within 1 dB.

NOTE

It is normal for the distortion reading to drop when the input signal is reduced 10 dB below set level mark at 100 kHz. This is because the residual distortion of the analyzer has been greatly reduced with the decrease in input level at 100 kHz.
(A bonus benefit from the Auto-Set-Level Option).

l. Depress VOLTS/POWER function switch, change INPUT switch to 1V, and change Oscillator frequency to X100, 10 (1kHz). Decrease OSCILLATOR LEVEL control rapidly until OVERLOAD indicator is extinguished. Then increase OSCILLATOR LEVEL very slowly until OVERLOAD indicator just begins to glow (adjust control back and forth if necessary to find the point at which indicator just starts to light).

m. Now change INPUT switch to the 3V position and note meter reading. Meter pointer should be between -9.5 and -8.5 on dB scale (106 and 118 on 0-3V scale).

CALIBRATION PROCEDURE FOR
1700A AUTOMATIC SET-LEVEL OPTION

a. Center all four trim-pots on Auto-Set-Level PC board and turn power on.

b. Connect oscillator SIGNAL OUTPUT to analyzer INPUT.

c. Set 1700A controls to:

INPUT switch	300V
FUNCTION	SET-LEVEL
ADJUST control	CAL (Max. CCW-Just before click)
RATIO switch	0 dB (100%)
FILTERS	Both Off (out)
FREQUENCY	X 100, 10 (1 kHz)
F.R./L.D.	FAST RESPONSE
SIGNAL COMMON Switch	⏚

d. Set OSCILLATOR LEVEL at minimum (fully CCW). Measure DC voltage at (+) terminal of C7 (10 Microfarad) with respect to ground (-terminal of C15). Adjust zero trim-pot R21 for 0 Volt (±1 mV) DC.

e. Change INPUT switch to 1V and adjust OSCILLATOR LEVEL for exactly full scale (set level mark.)

f. Change FUNCTION to dB VOLTS and note the exact position of meter pointer on 0 to 1 scale.

g. Click the ADJUST control to • AUTO position.

h. Measure DC voltage at N.C. contact of relay K1 (as shown on parts location diagram) with respect to ground (negative terminal of C15). Adjust zero trim-pot R20 for zero volts DC ± 5 mV.

i. With INPUT switch in 1V position, adjust F.S. trim-pot R7 for the same pointer position as in step f.

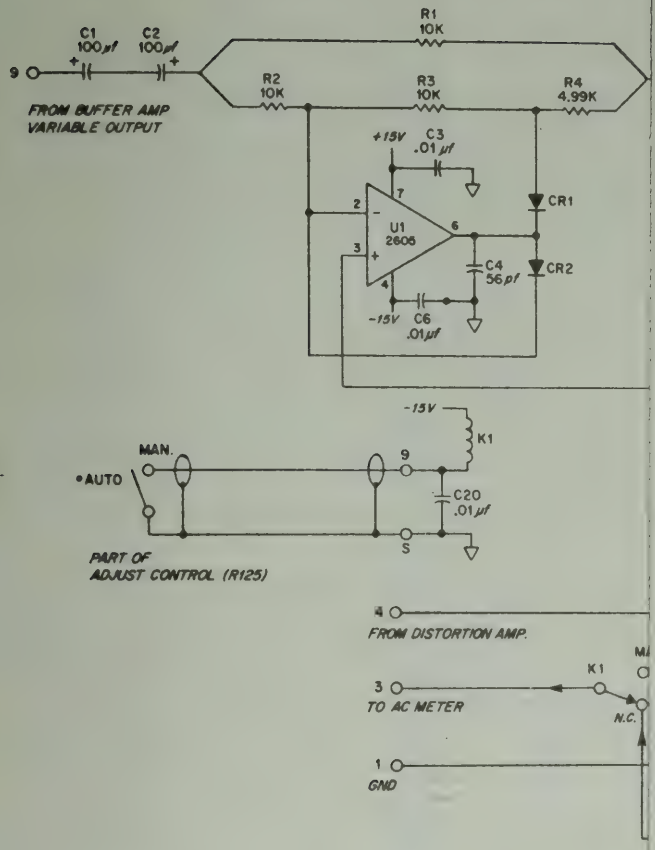
j. Change INPUT switch to 3V and adjust offset trim-pot R14 for the same pointer position as in step i.

k. Repeat steps i and j until meter pointer rests on the same spot, ±.1% of full-scale (± one line width).

TROUBLE-SHOOTING

The Auto-Set-Level circuit is an open-loop type, so straightforward signal tracing techniques can be used to locate defective parts. The entire circuit block is always active, even in the manual mode.

With full-scale output at the Buffer Amplifier, the Multiplier should have unity gain. With .316 of full-scale Buffer output, the Multiplier gain should change to 3.16.



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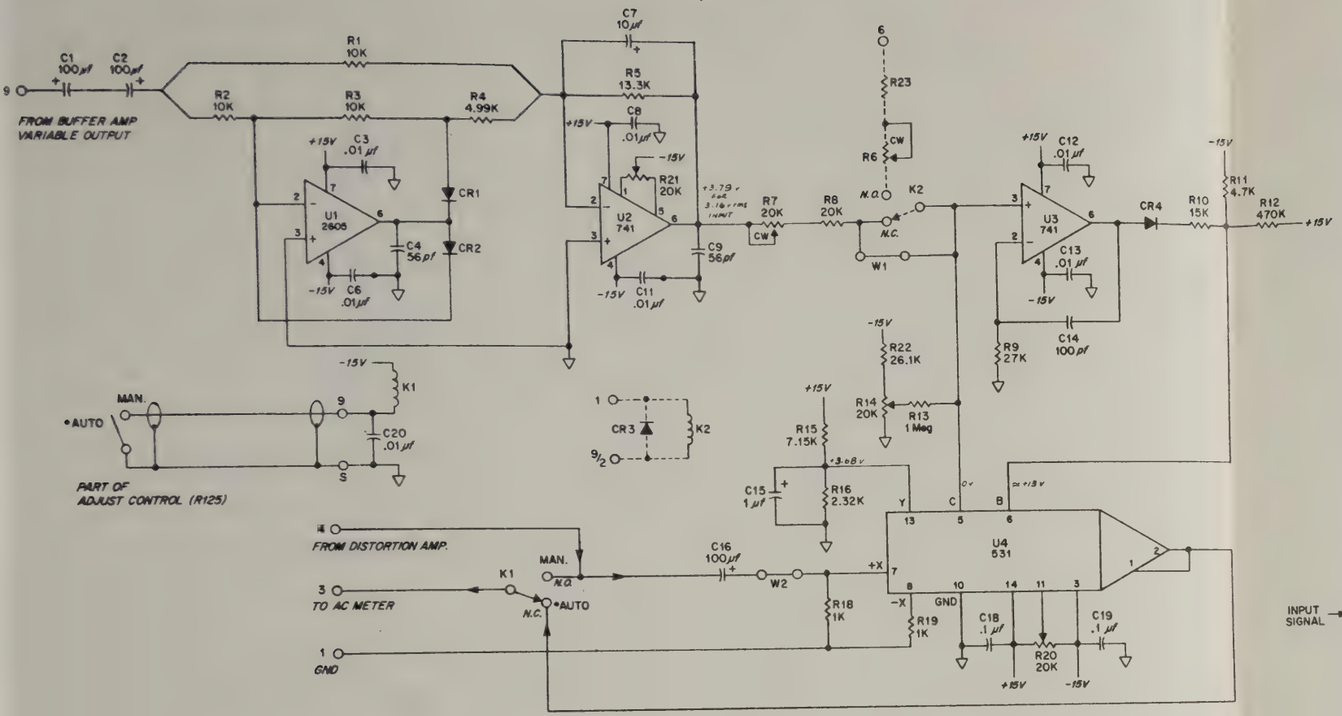
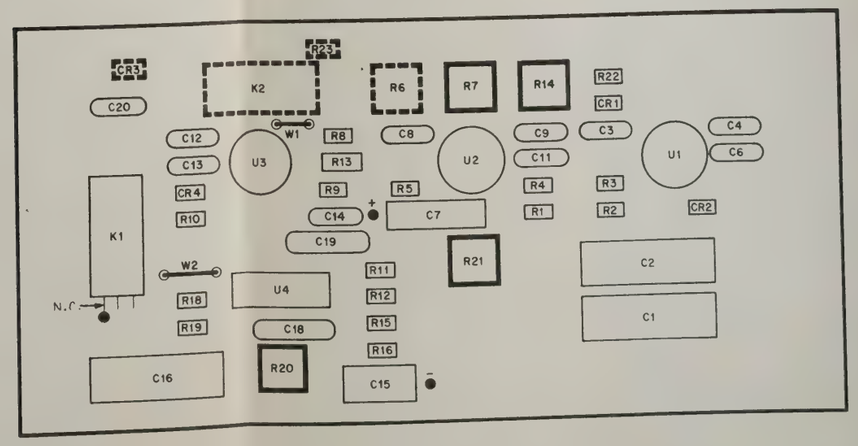
AUTO SET LEVEL OPTION

5-31-75





SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

AUTO SET LEVEL OPTION

5-31-75

01700-30016 ASSY-PC
AUTO SET LEVEL OPT 003

PART NO	DESCRIPTION	QTY
0100-0001	IC-OP AMP 741 U2,3	2.0
0100-0010	IC-OP AMP 2605 GRADE 5 GREEN U1	1.0
0100-0015	IC-MULTIPLIER AD531JD U4	1.0
0200-0000	DIODE-GEN 1N914A SI CR1,2,4	3.0
1015-1232	RES-FXD 2.32K 1% 1/8W MF R16	1.0
1015-1499	RES-FXD 4.99K 1% 1/8W MF R4	1.0
1015-1715	RES-FXD 7.15K 1% 1/8W MF R15	1.0
1015-2100	RES-FXD 10K 1% 1/8W MF R1,2,3	3.0
1015-2133	RES-FXD 13.3K 1% 1/8W MF R5	1.0
1015-2200	RES-FXD 20.0K 1% 1/8W MF R8	1.0
1015-2261	RES-FXD 26.1K 1% 1/8W MF R22	1.0
1015-4100	RES-FXD 1M 1% 1/8W MF R13	1.0
1100-1100	RES-FXD 1K 5% 1/4W R18,19	2.0
1100-1470	RES-FXD 4.7K 5% 1/4W R11	1.0
1100-2150	RES-FXD 15K 5% 1/4W R10	1.0
1100-2270	RES-FXD 27K 5% 1/4W R9	1.0
1100-3470	RES-FXD 470K 5% 1/4W R12	1.0
1410-0007	RES-VAR 20K TRIMPOT CERMET R7,14,20,21	4.0
2000-0056	CAP-FXD 56PF 5% 500V MICA C4,9	2.0
2000-0100	CAP-FXD 100PF 5% 500V MICA C14	1.0
2040-0000	CAP-FXD 0.01UF 100V CERAMIC C3,6,8,11-13,20	7.0
2040-0002	CAP-FXD 0.1UF 25V CERAMIC C18,19	2.0
2100-0001	CAP-FXD 1UF 25V ELECT AL C15	1.0
2100-0003	CAP-FXD 10UF 25V ELECT AL C7	1.0
2100-0006	CAP-FXD 100UF 25V ELECT AL C1,2,16	3.0
3105-0000	SOCKET-IC 8 PIN ROUND	3.0
3105-0001	SOCKET-IC 14 PIN DIP	1.0
3400-0001	RELAY-1 FORM C K1	1.0
7200-0000	WIRE JUMPER-0.4 CTRS,PVC INSUL	1.0
7200-0001	WIRE JUMPER-0.2 CTRS,PVC INSUL	1.0
8540-0004	SCREW 6-32 X 1/4 POZI PAN HD	2.0
8542-0001	LOCKWASHER-EXT #6	2.0
8702-0002	SPACER-THD,6-32 3/8LG X 5/160D	2.0
01700-5016	PC BOARD-AUTO SET LEVEL OPT003	1.0

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